Small Business Innovation Research/Small Business Tech Transfer

Multi-Band Software Defined Radio Sensor System, Phase I

Completed Technology Project (2018 - 2019)

Project Introduction

This Multiband Software Defined Radio (SDR) sensor system proposal will demonstrate the ability to operate within multiple frequency bands and across multiple technology platforms in a single transceiver. The center frequencies and bandwidths chosen are representative of current demonstrated commercial or research devices and bands used: 400 MHz, 900 MHz, and 2.4 GHz ISM bands, with bandwidths of approximately 10 MHz, 26 MHz, and 100 MHz, respectively. SAW sensor development proposed is for a cryogenic to high temperature sensor, high temperature strain sensor, and magnetic field sensor. Demonstration of other passive technology sensors will also be demonstrated.

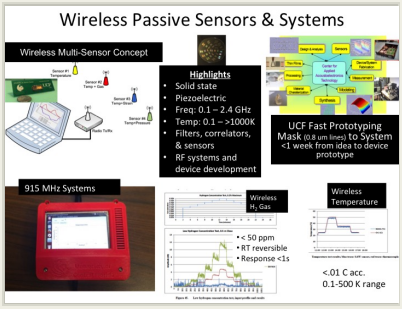
This proposal presents a series of technical objectives that will have a significant benefit to a broad range of wireless sensors, and advance the state-of-the-art and capabilities in sensor technology. The effort will demonstrate a multiband software defined radio (SDR) sensor transceiver that can interrogate any passive resonator or delay line technology sensor within a given band. The proposed sensor systems will lead to improved safety, reduced test, and space flight costs by providing real-time analysis of data, information, and knowledge through meshed wireless networking.

The SDR system approach has the following advantages and advancements:

- Switchable bands
- Software defined center frequency and bandwidth
- Low cost configurability
- Easy and fast programmability of SDR and post processing
- Works with any passive sensor within the given RF band, temperature, strain, gas, magnetic field and others
- Maximize signal-to-noise ratio for a given sensor type, i.e., resonator, delay line, CDMA, OFC, etc. by minimal hardware changes
- Software for parameter extraction of multiple measurands
- Simultaneous interrogation of all in-band sensors
- Multiband-switchable system: contiguously measure sensors across frequency bands
- Wireless network connectivity for information and data logging from multiple sites and sensors

Anticipated Benefits

Wireless measurements on rotating parts - Temperature & strain, Wireless passive sensors in wings, fuselage, or other inaccessible points - Temperature & strain, Wireless sensor networking and SHM master monitor, Wireless massively deployed sensors, Inflatable habitats - Inside/outside



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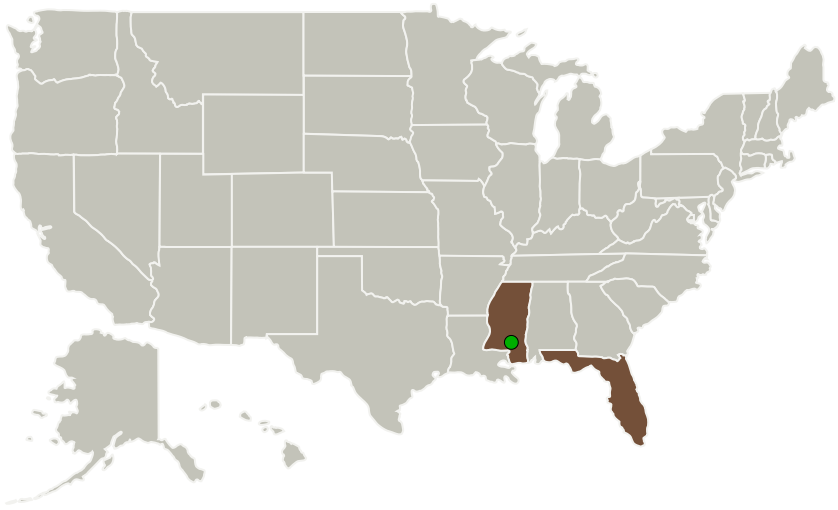
temperature, Gas monitoring, Strain/stress of components, Hydrogen gas sensing - Launch vehicles & Ground facilities, Cryogenic gas and liquid monitoring for launch vehicles

Airplane cabin & landing gear SHM, Sensor monitoring of inaccessible areas, within the fuselage or wings of airframes, Hydrogen, methane, ammonia, humidity, gas and other wireless passive sensors - Hydrogen fueled vehicles, Gas cylinders, Nuclear reactors, Transportation (Bridges, highways, etc.) wireless monitoring - Concrete curing, Corrosion, Strain, Military and commercial aircraft SHM, Engine/ turbine monitoring - Gear temperature, Exhaust tempersture, Cryogenic liquid and gas monitoring

Primary U.S. Work Locations and Key Partners



Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Pegasense, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

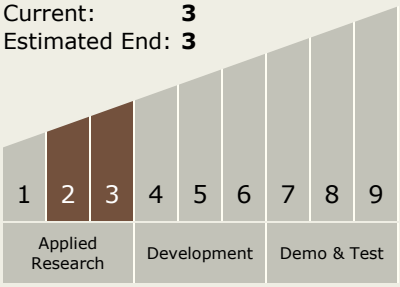
Carlos Torrez

Principal Investigator:

Donald C Malocha

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Organizations Performing Work	Role	Type	Location
Pegasense, LLC	Lead Organization	Industry Women-Owned Small Business (WOSB)	Winter Springs, Florida
Stennis Space Center(SSC)	Supporting Organization	NASA Center	Stennis Space Center, Mississippi
University of Central Florida(UCF)	Supporting Organization	Academia Hispanic Serving Institutions (HSI)	Orlando, Florida

Primary U.S. Work Locations	
Florida	Mississippi

Project Transitions

July 2018: Project Start

August 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137864)*

Technology Areas

Primary:

- TX02 Flight Computing and Avionics
  - TX02.1 Avionics Component Technologies
    - TX02.1.8 Wireless Avionics Technologies

Target Destination

Earth

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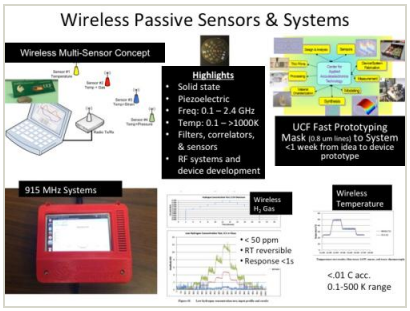
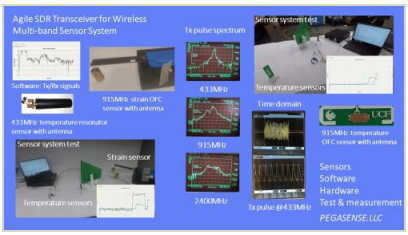
Images



Briefing Chart Image
Multi-Band Software Defined Radio Sensor System, Phase I
(https://techport.nasa.gov/image/135751)



Final Summary Chart Image
Multi-Band Software Defined Radio Sensor System, Phase I
(https://techport.nasa.gov/image/128650)